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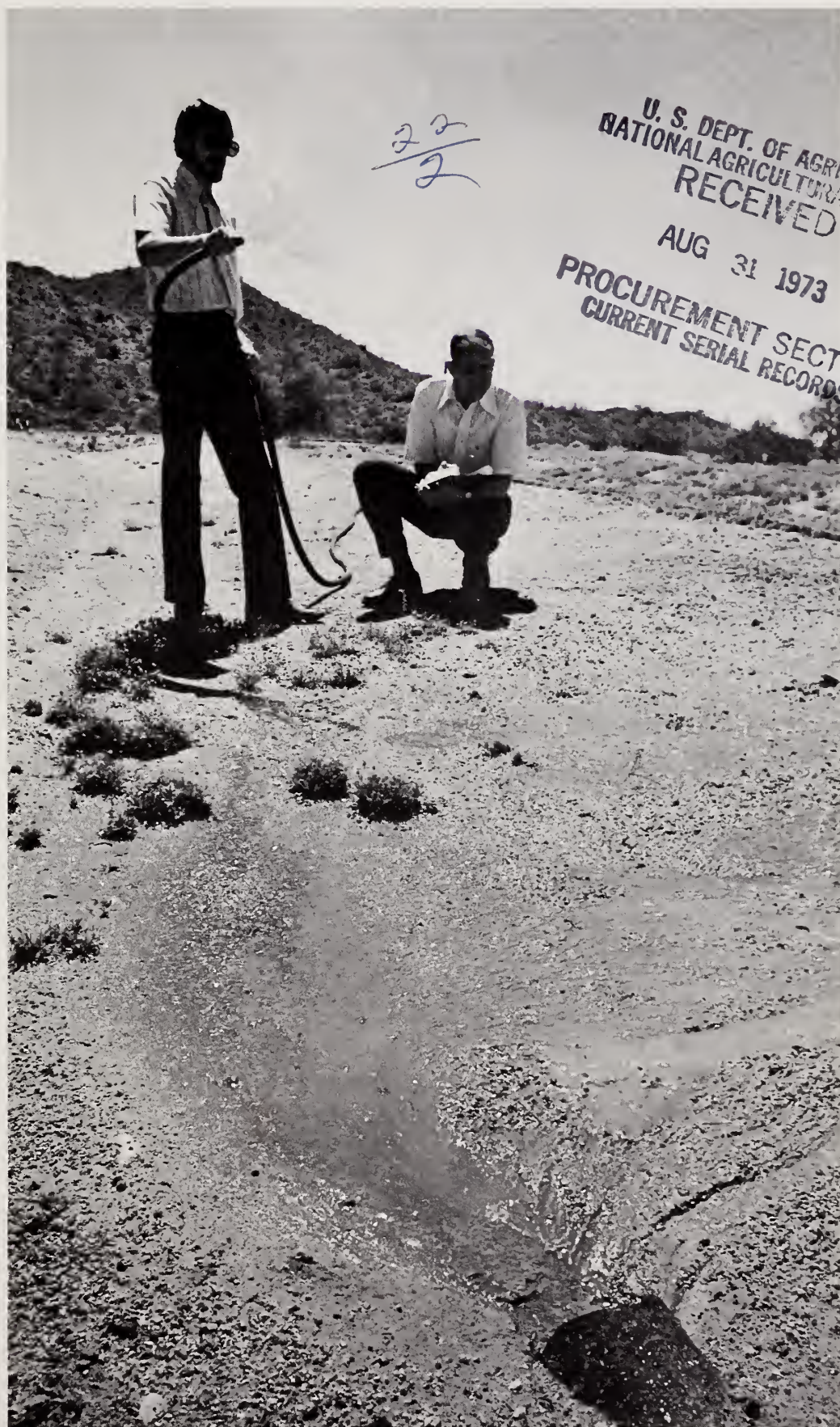
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Energy for Agriculture

As an energy crisis grips the nation, urban and suburban Americans increasingly take stock of the days ahead. Mr. Average Citizen of any great megalopolis views the energy crisis through the lens of his everyday experiences: gasoline to power his car, electricity to light and air condition his home, fuel of his choice to provide heat against winter. If he reflects on agriculture's energy needs at all, his mind probably conjures up a ready image of a hardworking tractor.

Mr. Average Citizen correctly assesses agriculture as being far down the list of society's main consumers of energy. A typical American, for example, annually uses the energy equivalent of about 10 gallons of gasoline just to watch a black and white television set. By that standard, agriculture's on-the-farm consumption of about 150 gallons of gasoline in growing and harvesting the food supply of one person does not seem extravagant. But agriculture's energy requirements are large and they do not end, or begin, on the farm.

Consider fertilizer. Along with advances in such fields as pest control, agricultural engineering, and genetics it has played a vital role in enhancing agricultural productivity. Indeed, authorities state that a least 30 percent of the increased yields of U.S. grain crops can be attributed to fertilizers. Despite national concern about energy supplies, few people are aware that the fertilizer industry consumes 3 percent of the natural gas supply, that energy expended in producing nitrogen fertilizer equals about 8 gallons of gasoline for each American, that the shovels which mine phosphorous for fertilizer are powered by electricity.

There are other and significantly larger off-the-farm demands for energy. These include energy expended in manufacturing farm machinery and supplies, and in processing, transporting, and distributing food from farm to table. In the years ahead, all these energy needs will mount as agricultural production struggles to keep pace with population growth.

Agriculture can take constructive steps to obtain its fair share of energy. A national survey could be undertaken to identify energy-limiting situations and practices. Once these weaknesses have been identified, agricultural scientists and engineers can train their talents on developing alternatives to overcome any major limitations of energy. A rational plan coupled with commitment can assure agriculture of the energy it needs to produce for tomorrow.

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COVER: Water repellency of a paraffin treated watershed field plot is tested by Dr. Fink (left) and Dr. Cooley at the U.S. Water Conservation Laboratory, Phoenix, Ariz. (0573X419-8). See story on page 8.

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Mr. Amerault performs modified card test for anaplasmosis from serum samples collected in the field by state veterinarians cooperating in the evaluation of the card test prior to its release as an official testing method for anaplasmosis (0573X1054-3).

It's in the cards

RECENT IMPROVEMENT in the diagnostic capability of the card test for anaplasmosis will aid veterinarians in reducing the incidence of this costly cattle disease. The greater accuracy of the ARS-modified card test now makes it feasible to certify herds as "documented anaplasmosis-free"—a valuable designation when selling cattle.

Microbiologist Thomas E. Amerault and biochemist Joseph E. Rose discovered that the addition of bovine serum

factor (BSF) was a necessary component of the card-test system. Without BSF, early diagnosis of the disease with this test was difficult. A side benefit is that serum from blood samples obtained in the USDA's market cattle testing program can now be card-tested for anaplasmosis. Previously, when these samples reached the laboratory, they were too old for accurate anaplasmosis diagnosis with the unmodified card test.

Scientists evaluated the modified test

by comparing its results with those of the highly accurate compliment-fixation (CF) laboratory test. Agreement between the two tests was 97 percent on samples from naturally infected cattle and 100 percent on samples from experimentally infected cattle. Results of the unmodified card test were only 85 percent in agreement with the CF test on both types of samples.

The card test was originally developed by Mr. Amerault and veterinarian Thomas O. Roby, Beltsville, Md. (AG. RES. April, 1969, p. 7). It is simple, accurate, and inexpensive. Equipment required for each test is disposable and costs only a few cents. Here is how the modified test works:

For field testing at the farm or ranch, a small sample of blood—1 milliliter—is drawn from the tail vein of the cow into a special small plastic ampule con-

taining anticoagulant. The sample is centrifuged to separate the plasma and blood cells. A drop of the plasma is placed on the test card. To it are added one drop of antigen (the cleaned, killed anaplasmosis parasites) and one drop of BSF. The fluids are mixed on the card for 4 minutes. Presence of the disease is indicated by tiny, granular, blue-green clumps in the solution (agglutination). If no clumps form, the test is negative.

Wide-scale use of this modified card test should help greatly in eventually eliminating this disease, which costs cattlemen an estimated \$50 million a year in dead cattle and in lost milk and meat production. Veterinarians of the USDA's Animal and Plant Health Inspection Service plan to put the modified test to work next fall after personnel are trained to perform the test. □

Blood sample to be tested for anaplasmosis is taken from a cow by Dr. Roby (0573X1055-12).





In a field experiment with the new diagnostic tool Mr. Amerault adds Bovine Serum Factor (BSF) to a test card prior to mixing (0573X1056-21).

*Anaplasmosis is caused by a tiny parasite, *Anaplasma marginale*, which invades the red blood cells of cattle. Once in a cell, the parasites multiply, destroying the cell. The infective parasites thus released into the blood stream invade new cells and begin the multiplying process again. At times the parasites destroy blood cells faster than they can be replaced.*

Ticks and biting insects—mainly flies and mosquitoes—spread the disease from infected to healthy animals. Anaplasmosis is not spread through contact between animals or by urine or feces. The disease may also be spread by man, if unsterilized equipment is used to bleed, vaccinate, castrate, or dehorn infected cattle and in turn used on healthy ones.

Anemia is the major symptom in anaplasmosis-infected cattle. As a result, the animals' lips, nostrils,

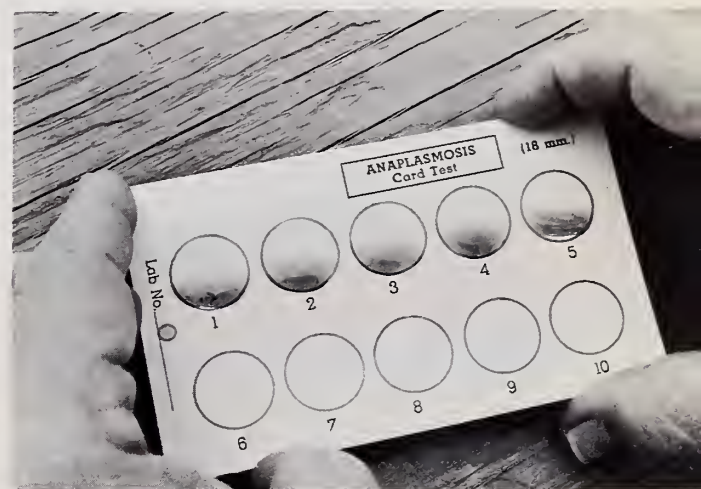
and other mucous membranes turn pale. Infected cattle breathe heavily, lose their appetite, are constipated, and become weak and unthrifty.

The death rate from anaplasmosis in infected herds may be as high as 50 percent or as low as 1 percent. Older heifers and recently fresh cows are the chief mortality victims. Bred heifers may abort, and milk production drops in infected cows.

Adding a tetracycline formulation to the feed for 45 days is the recommended treatment for anaplasmosis in beef cattle. (This medication is not registered for use on dairy cattle.) Necessary preventive measures include detection of carriers in herds and their removal to other quarters; application of insecticides to discourage ticks and biting insects; and sterilization of instruments used on cattle.



Above: A single drop of BSF is placed on card for each sample tested (0573X1056-7). Below: This completed modified anaplasmosis card test shows samples 1, 2, and 3 to be positive as indicated by the tiny granular clumps. Samples 4 and 5, having no clumps, tell of negative reactions (0573X1056-17).





Twin blasts of resmethrin dust quickly permeate 15,000 cubic-foot calf barn at Beltsville, Md., in tests conducted by Dr. Morgan (right) and agricultural engineer Henry J. Retzer. Portable dust gun is powered by carbon dioxide (0573A473-9).

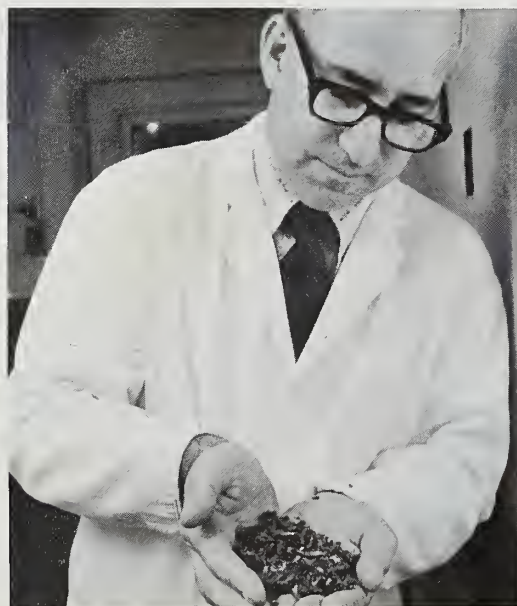
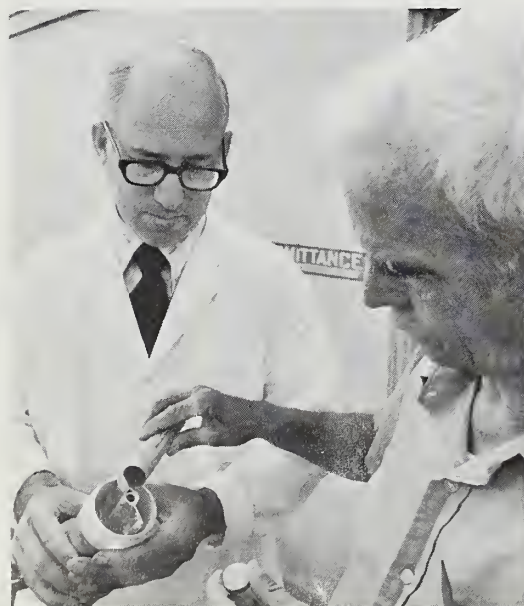
Pushbutton insect control ?

PUSHBUTTON CONTROL of house flies, stable flies, and roaches may be near at hand, according to results of recent tests with a safe, experimental insecticide applied as a superfine dust.

This insecticide is resmethrin, a synthetic compound related to pyrethrum. It knocked down stable flies within 10

minutes and house flies within 30 minutes. "Knock-down" ability is used by entomologists as a measure of initial effect of some insecticides. Within a few hours of knock down, scientists noted that flies exposed to resmethrin were all dead. The roaches exposed to resmethrin died within 24 hours.

Left: Dr. Morgan holds aerosol dust gun while Mr. Sullivan loads it with micronized resmethrin dust (0972W1308-3). Right: Dr. Morgan examines sample of dead flies collected in calf barn only 10 minutes after resmethrin treatment. The treatment killed 100 percent of the flies (0972W1308-16).



Resmethrin's effect on roaches is particularly promising, because the test insects were selected from a laboratory colony that is resistant to most other insecticides. Moreover, the fine dust penetrates cracks and other places where roaches hide.

The synthetic compound, like pyrethrum, a natural insecticide obtained from plants, has no undesirable long-lasting residues. It is virtually harmless to warm-blooded animals. Pyrethrum is one of the least toxic of pesticides to warm-blooded animals and resmethrin is even safer and more effective in controlling pests.

Entomologists Neal O. Morgan and William N. Sullivan and chemist Milton S. Schechter, Beltsville, Md., developed an application method as simple as pushing a button. They placed about 0.25 ounce of micronized resmethrin dust in a double-nozzle dust gun. Micronized dust consists of ultrafine particles produced by a special milling process.

The dust gun is powered by a burst of carbon dioxide (CO₂) gas, from a fire extinguisher-type tank. This unit can be held in the hand or mounted on a post. When the lever on the CO₂ tank is pressed for less than a second, gas is released into the gun under sufficient pressure to blast the dust throughout the treatment area.

The researchers obtained consistently good results in barns measuring 15,000 cubic feet. The dust also has potential for use in homes and other places where flies and roaches are a nuisance.

To ensure stringent test conditions, the scientists released several thousand flies in the test barns before the experiments began. These barns were crowded with calves, which attract more flies than do mature animals. Despite the crowded conditions, the resmethrin dust achieved good distribution throughout the treatment area.

Micronized resmethrin dust is not registered with the Environmental Protection Agency for use against flies or roaches. □

Exotic corn resists pest

AN EXOTIC STRAIN of corn brought to the United States from South America may provide a source of resistance to corn earworm for Midwest corn strains.

Corn earworm is probably the most destructive insect pest of corn in the United States. Field corn yields are reduced by some 4 percent each year because of corn earworm damage but percentage losses are even greater in sweet corn, nearly 14 percent. Corn earworm larvae feed on the buds or central shoots of young corn plants, while later generations of worms can destroy kernels, and prevent pollination. Their feeding activities may allow molds to enter.

The corn strain found to be resistant to corn earworm is Zapalote Chico. After scientists learned of the resistance factor, ARS plant geneticist Marcus S. Zuber began a study to determine if the resistance could be transmitted to topcross progenies of the strain. Topcrossing, as used in this study, is a breeding process in which several single crosses were crossed with common

parental varieties. The parents were Zapalote Chico, having resistance to earworm, and Iowa Super Stiff Stalk Synthetic, a susceptible source used for comparison purposes.

The experiment was conducted in cooperation with entomologists Richard W. Straub, Mahlon L. Fairchild, and Armon J. Keaster at the Missouri Agricultural Experiment Station, Columbia. Zapalote Chico and Iowa Stiff Stalk Synthetic strains were topcrossed on seven single crosses to produce 14 topcrosses.

All strains were subjected to natural earworm infestation and evaluated at maturity for larval penetration and earworm damage. Larval penetration was measured from the cob tip to the point of deepest penetration. Without exception the seven topcrosses with Zapalote Chico had the least larval penetration and general earworm damage.

The seven single crosses used in the experiment had a wide range of maturity. Zapalote Chico readily transmitted earworm resistance to its progeny regardless of the maturity of the

single crosses involved in these tests.

From earlier studies, Dr. Straub and Dr. Fairchild reasoned that the earworm resistance may be caused by some chemical factor in the silks that acts as a feeding deterrent or growth inhibitor to the earworm. They had fed fresh, freeze-dried silks from Zapalote Chico corn and from a susceptible variety to groups of corn earworms. The worms that were fed the Zapalote Chico corn silks had significantly lower larval weights at 8 days.

Dr. Zuber said that although Zapalote Chico has some undesirable features, such as rough, tough, and tight husks, its source of resistance to corn earworm may enable breeders to upgrade resistance in different strains used for production in the corn belt.

In another experiment conducted in cooperation with Georgia Agricultural Experiment Stations, Tifton (AGR. RES., Dec. 1971, p. 18), scientists found that an experimental sweet corn variety, resistant to corn earworm, required considerably less reliance on insecticides than did a susceptible variety. □

The destructive corn earworm feeding on an ear of corn (BN-38560).





Above: Researchers presently hand-apply paraffin wax on the test plots where it will be melted by the sun to form a water-repellent surface. The 11-pound blocks of paraffin will be ground for this purpose in an ordinary garden trash shredder (0573X418-19). Below: Besides paraffin wax, researchers at Phoenix are field-testing silicones, and other water-repelling materials on various soils. Here, Dr. Fink inspects test plots where this research is underway (0573X417-28)



Center: In other experiments using paraffin wax to reduce evaporation losses in water-storage tanks and ponds, solid blocks of wax (left and right rear) have been permitted to melt under the sun's rays to form a complete cover. Mr. Griggs and Dr. Cooley observe chunks of foam paraffin (0573X416-7).

Left: This laboratory experiment at-tests to the water-repellent properties of wax impregnated soil (0573X415-16). Below: Mr. Griggs changes the recording on a pyroheliograph, an instrument which records the intensity and amount of sunlight (0573X417-8).

Wax helps harvest water

FOR YEARS water harvesters have been looking for a cheap, easy method of treating small watersheds to make them watertight—or nearly so. They may have found their answer through the use of a simple substance, paraffin wax.

After trying a number of other substances, ARS scientists at the U.S. Water Conservation Laboratory, Phoenix, Ariz., applied paraffin wax as granules or flakes on top of the soil of two experimental watershed plots. The wax melted and spread in the hot desert sun and formed a water-repellent soil surface which readily sheds water. In tests, the wax-treated plots yielded an average of 90 percent precipitation runoff, compared to only 30 percent runoff from two similar untreated plots.

Water harvesting, the process of collecting water from spots treated to increase runoff from rainfall or snowmelt, offers the promise of supplying low-cost water for arid rangelands and also supplying other water-short areas.

The livestock-carrying capacity of many rangelands, surprisingly, is not limited so much by a shortage of grass as it is by the lack of drinking water. Reliable sources of water often are too far apart or too costly to build and maintain. Wells are oftentimes impractical because of unfavorable geology or excessive drilling costs.

Stock water dams are used in such areas to collect runoff from small local watersheds. The dams offer only a partial solution, however, since most are dry for several months of the year. They are not dry for lack of rain, but rather because of the low runoff characteristics of the contributing watershed. By treating those contributing areas with paraffin wax or other substances, rainfall in even the arid regions may be adequate to keep water in the dams throughout the year.

The wax used for treating the soil is the common refined paraffin type with such commercial uses as making candles and coating wax paper and milk cartons.

And since such waxes are already approved for human use, contamination from micro-quantities present in water is of little concern.

Although the wax used in the Arizona studies had a melting point of 120° F., there are a variety of melting point temperatures available permitting proper selection to facilitate melting at the prevailing soil temperatures.

Quality of the runoff water from the wax plots is very good with the naturally-occurring salt content less than 50 parts per million and organic matter almost undetectable.

Paraffin wax can be bought from the manufacturer in quantity in 11-pound slabs at about 10 cents a pound. It is too early to tell how long the wax treatment remains effective. If it lasts long enough to yield 20 inches of runoff (for example, about 2 years if the annual rainfall is 10 inches), the cost of materials in terms of the harvested water is about \$1.00 per 1,000 gallons.

Several methods of grinding the wax

were tried—a hand grinder, an electric grinder, and a high-speed wood plane—and although they all reduced the wax to a usable form, a better method may be the use of a lawn and garden trash shredder.

Soil scientist Dwyane H. Fink, hydrologist Keith R. Cooley, and hydraulic engineer Gary W. Frasier are continuing the study to evaluate long-term durability, among other things. The scientists will check on minimal effective application rates and develop a machine to spread the wax. Experimental plots were treated by hand.

The technique, the scientists feel, is especially well adapted for the rancher who needs additional water supplies in remote areas, and who does not wish to invest a large amount of money in supplies and equipment.

Water obtained from the paraffin plots should be safe for human consumption. Chlorination and filtering may be necessary for disinfection and sediment removal. □

... from the moon to the beehive

HONEY BEES have benefitted from moon explorations, in an unforeseen spinoff of space research. Bee diseases that cost producers millions of dollars annually can be controlled by a massive steam sterilizer originally designed to assure the germfree quality of equipment in spaceships.

ARS entomologist George E. Cantwell, Beltsville, Md., and Jacob C. Matthenius, Jr., supervisor of bee culture for the New Jersey Department of Agriculture, Trenton, obtained the surplus 5.5 ton sterilization unit from the National Aeronautics and Space Administration. After the 4x4½x7 foot unit was installed at New Brunswick, N.J., Mr. Matthenius and his associates adapted it to dispense controlled amounts of ethylene oxide (ETO), a gas used to sterilize hospital equipment that cannot be exposed to high temperatures. ETO fumes decompose readily, posing no environmental hazard.

Laboratory tests by Dr. Cantwell and others had demonstrated the potential usefulness of ETO in con-

trolling bee diseases. Mr. Matthenius' tests confirmed these results on a commercial scale.

With the big sterilizer, 40 hive units can be treated at the same time at a cost of about \$13, or 35 cents per hive unit. In contrast, the standard remedy—burning infected hive units—results in a \$100 loss to the beekeeper. Burning also violates environmental protection laws in many areas.

Mr. Matthenius has treated more than 2,000 pieces of hive equipment with the ETO unit. Only two occurrences of bee disease were discovered after treatment. They are believed due to post-treatment contamination rather than inadequate sterilization. The treatment also destroys eggs of the greater wax moth—a bee and honey pest that causes losses of more than \$500,000 annually.

The New Jersey Agricultural Experiment Station cooperated in this research. The Connecticut, Maryland, and Virginia Experiment Stations are cooperating with ARS in similar tests, using various types of ETO units. □

Fungus attacks ancient tree

A COMMON FUNGUS that causes white rot in apples and cankers on red-bud and many other trees and shrubs has succeeded in infecting trees of a genus that dates back some 60 million years to Mesozoic times.

The dawn redwood, *Metasequoia glyptostroboides*, was recently found to be infected with cankers caused by a fungus known officially as *Botryosphaeria dothidea* (= *B. ribis*). Scientists at the U.S. National Arboretum, where the infected trees are growing, call the disease *Metasequoia* canker.

Authorities believed the *Metasequoia* tree to be extinct for millions of years until botanists discovered living trees in China only about 25 years ago. These so-called "living fossils" were quickly made available to institutions throughout the world, including the Arboretum. The trees were rapidly reproduced, and today, they are found growing in nearly every State in the country. Their interest lies not so much in their ornamental value, which is moderate, but in their extraordinary historical heritage.

Because of the tree's antiquity (having withstood the ravages of time and pests), many horticulturists believed *Metasequoia* would be relatively immune to fungus diseases. Therefore, discovery of the cankers on nearly half the 95 trees of seedling origin at the Arboretum was a surprise. Also surprising, according to Frank S. Santamour,

Needle arrangement of the dawn redwood bespeaks its relationship to our American bald cypress and the California redwood (0573X1057-3).





Fungus forming on Metasequoia is observed by Dr. Santamour at the National Arboretum (0573X1058-16).

Jr., tree geneticist at the Arboretum, and R. Jay Stipes, plant pathologist at Virginia Polytechnic Institute, Blacksburg, is the seemingly localized nature of the infection, which appears to be restricted to the Washington, D.C. area. Despite the fact that *Metasequoia* is widely grown and the fungus itself is widespread, scientists have received no reports of similar infection elsewhere. Anyone detecting cankered trees is asked to report them to Dr. Santamour at the National Arboretum, Washington, D.C. 20002.

Dr. Santamour and Dr. Stipes believe that the fungus enters the main trunk through infections on living lateral branches. Cankers form on the trunk near the base of the branches. Resin exudes from the infected area and dries as a white material on the trunk. The *Metasequoia*, which, by the way, is related to our own indigenous giant sequoias, does not normally have resin canals. The fungus apparently stimu-

lates production of "traumatic" canals. So even a small amount of the resinous substance is proof of infection.

The fungus infection spreads slowly around the trunk of the tree and eventually kills living branches. When the entire trunk is girdled, it may kill the top of the tree. The tree itself does not die, but its desirability as an ornamental is reduced with bare spots where branches and leaves should be.

Trees that are free of the *Metasequoia* canker at the Arboretum have been selected and propagated and are being tested by artificial inoculation to determine their resistance to the disease. □

Dying uppermost branches of Metasequoia tell of girdling by the fungus, Botryosphaeria dothidea. Dr. Santamour walks among infected specimens at the National Arboretum (0573X1058-17).



the nocturnal sugarbeet

THE SUGARBEET is something of a night owl.

In a study on determining the response of sugarbeets to irrigation, ARS scientists learned that sugarbeet roots grow late in the evening and at night and have a tendency to shrink at midday. They also experience about 3 days of slowed growth immediately following irrigation or rainfall.

Results of this study may prove helpful to farmers both in irrigating their sugarbeet crops and in choosing the best possible time for harvest.

The study was conducted by soil scientist Wendell C. Johnson and agricultural research technician Ronald G. Davis, Bushland, Tex. The tests were made during a period relatively free of rain so they could best monitor root response to moisture. Over a 48-day period, roots were given staggered irrigation dates so that the growth record

of a root not being irrigated at a particular time could be used as a basis for interpreting the growth response to irrigation of another root.

A slow-growth period averaging 3 days in length occurred after each of six irrigations due either to poor aeration, cooling of the soil, or both. The slow-growth period was considered to end when the irrigated root began to grow faster than the unirrigated root.

Interestingly, root growth occurred mainly at night, usually starting between 5 and 7 p.m., reaching a maximum rate near sunset, and stopping around 7 or 8 a.m. Some shrinkage usually occurred during midday and was directly proportional to the degree of moisture stress.

Future research will include studies to determine the reasons for these somewhat unexpected responses of sugarbeets to irrigation. □

feeding for less saturated fat

VEAL with less saturated fat can be produced by feeding calves diets high in polyunsaturated fats.

ARS scientists at Beltsville, Md., found this out in a two-part experiment with calves fed from weaning to 18 weeks of age. In the first part of the experiment, two groups of calves were fed either polyunsaturated or normal whole milk, from weaning to 10 weeks of age. Both diets were supplemented with vitamin E, and grain and alfalfa were fed free choice.

Polyunsaturated milk is produced by cows that have been fed a protected, unsaturated vegetable oil—in this case, a mixture of safflower oil and casein, treated with formaldehyde (AG. RES. March, 1972). Normally, unsaturated fats fed to cattle become saturated in the rumen. This does not happen to the formaldehyde-protected oil, which remains unsaturated as it passes through the calf's digestive system. Feeding the protected oil increases the amount of unsaturated fat and reduces the amount of saturated fat in both milk and meat.

At 10 weeks of age, half of the calves in the test groups were put on a diet containing 300 grams per day of the formaldehyde-protected mixture of safflower oil-casein mixture without formaldehyde protection. The oil-casein supplements were fed in addition to the grain ration for 8 weeks. All calves grew vigorously and maintained normal health.

Calves fed the polyunsaturated milk first and then the protected oil had four times as much unsaturated fat as the control animals. The fat examined was that stored under the skin and around the kidneys and intestines. Intramuscular or marbling fat was twice as unsaturated in calves fed the polyunsaturated diets.

Veal containing high levels of polyunsaturated fats may be of benefit in lowering the saturated fat content of human diets. If a definite link is found between heart disease and saturated fats, feeding for less saturated fat in cattle may be an economical way to reduce dietary fat intake. □

If Sarka arrives

SARKA DISEASE of plum and apricot is destructive in 14 European countries, but is not, as yet, in the United States. Recent ARS-sponsored Yugoslav research has shown ways to prevent or delay entry of Sarka and has provided a basis for controlling this disease in the event of its accidental introduction.

In what would have been high risk research if conducted in this country, Dr. Dragoljub Sutic, principal investigator, has identified certain host plants and carriers of the disease, isolated three strains of the virus, and developed an antiserum.

Dr. Sutic found that *Prunus spinosa*, a common wild plum, is a symptomless carrier of the virus, and that several weed species, widely distributed in nature, are hosts for Sarka virus. The popular garden plant zinnia is also a carrier.

Moreover, Dr. Sutic proved that *Prunus mahaleb*, reportedly a nonhost and a commonly used rootstock in the United States, is indeed a host. Five U.S. grown plum cultivars—Stanley, Ruth Gerstetter, California Blue, Ersinger, and Agen—tested tolerant. However, the Italian prune, which is widely grown in this country, proved highly susceptible, exhibiting severe necrosis and stunting when inoculated with Sarka virus.

Plant pathologist C. Lee Parish, ARS-cooperating scientist, Wenatchee, Wash., says this host range points to a need for revised plant quarantine procedures designed to exclude Sarka. "But," Dr. Parish said, "if we have to eventually live with this virus, the Yugoslav work of isolating three strains of the virus and the development of an antiserum has put us markedly ahead in research on the causal agent of this disease."

The three viral strains Dr. Sutic was able to purify and electron micrograph are those that cause dead or necrotic

spots on leaves, yellow leaf spot, and an intermediate strain that combines the expression of both symptoms. In the future, if the antisera can be perfected, it will facilitate rapid indexing procedures as well as aid in identifying divergent strains of this virus.

In addition to plant carriers, a number of aphid species have been confirmed as transmitters of this virus in

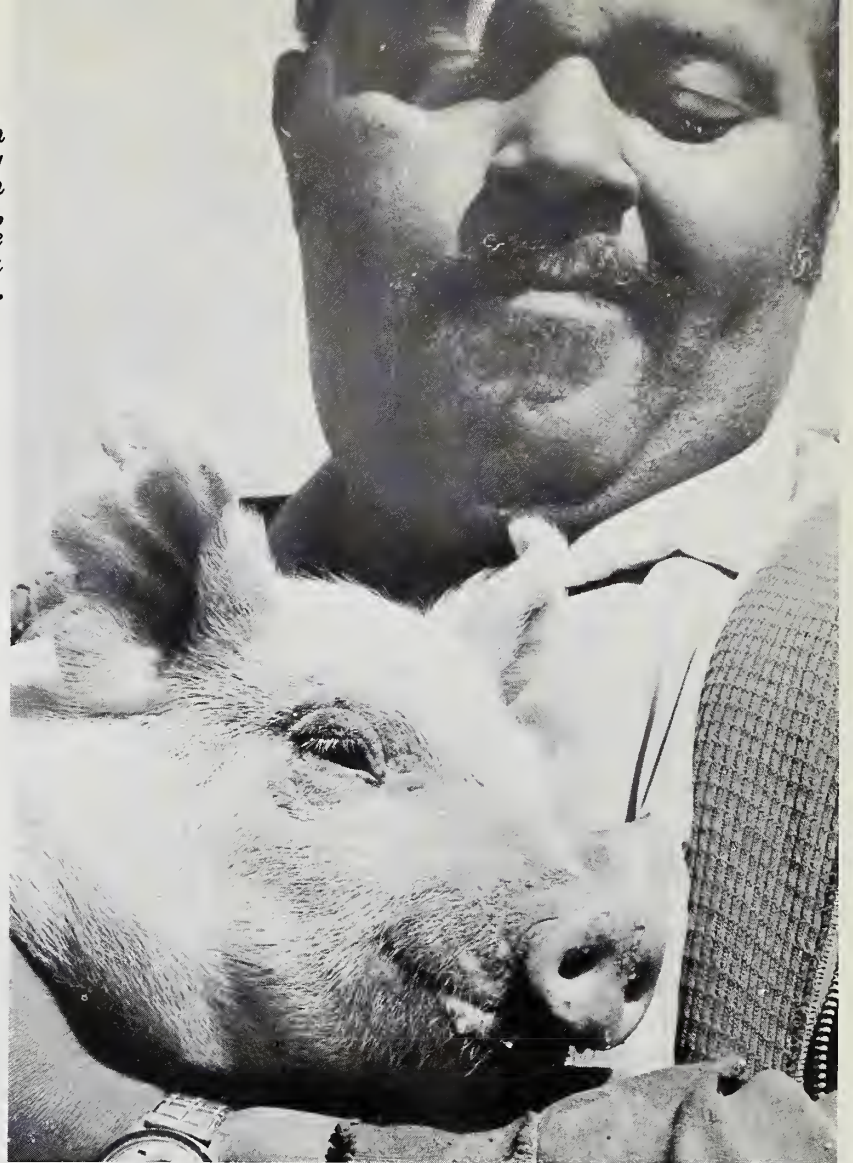
Europe. Four of the species tested, *Brachycaudus cardui*, *B. helichrysi*, *Myzus persicae*, and *Phorodon humuli*, also occur in the United States; therefore, the virus could be expected to spread rapidly if introduced.

The Yugoslav research was conducted under the provisions of Public Law 480 at the Institute for Agricultural Research, Sarajevo. □



Symptoms of Sarka are generally limited to the leaves of affected trees, but fruit symptoms appear on certain varieties. The virus causes chlorotic leaf spots, blotches, streaks, and ring patterns that vary in size, number, and distribution. Leaves (A) and fruit (B) of *Pozegaca* plum with symptoms of Sarka. (C) Vein yellowing and deformation of peach leaves infected with SV. (D) Leaves of *Crvena ranka* plum with symptoms of SV (PN-2836). Photo courtesy Plant Disease Reporter.

Right: Assistant herdsman William Yokley holds five-week-old crossbred pig (0473A303-5). Below: Duroc sow with crossbred pigs. Of the 12 pigs farrowed, this sow was able to wean 10. Average weight of the pigs at weaning was a hefty 28 pounds each (0473A302-8).



The baby pig problem

THE MALE is the weaker sex—at least where baby pigs are concerned. According to ARS studies, 51 percent of pigs born are males, but they have a 5 to 9 percent higher mortality rate than females.

These statistics are part of a study conducted on over 10,000 first litters of sows at eight Midwest agricultural experiment stations to determine factors related to baby pig death.

Baby pig deaths are the major problem in hog production. Most years, about 30 percent of the U.S. baby pigs die soon after birth. Seventy-five percent of the deaths occur in the first 3 days of life and most of the others die within 1 week after birth. One pig in every two litters is born dead.

The high mortality rate of baby pigs is a serious problem for producers. According to mid-1973 prices, it costs

about \$80 to produce a nine-pig litter based on a \$50 feed bill for the sow and an additional \$30 for labor, facilities, health care, and so forth. Therefore, at birth, each pig is worth \$9 and its value goes up each day.

Research has shown that if the producers could save one extra pig per litter, this would result in a national annual savings to the industry of about \$80 million in feed costs alone. Baby pig deaths now cost the industry about \$250 million per year.

In the cooperative State-ARS study, 71 percent of the pigs born alive reached 56 days of age, but another 5 percent died before reaching market size. Pigs that were heavier at birth stood a better chance of survival than did lighter litter mates.

Pig survival was also affected adversely by inbreeding, which caused a

decline of 1.2 percent in pig survival for each 10 percent increase in inbreeding. Also, litters larger than 8 or 9 pigs proved slightly detrimental to pig survival.

A major cause of baby pig death is crushing by a sow when she lays down on her litter. Other causes are digestive and respiratory illnesses and starvation from too few nipples on the sow.

Hereditary defects such as cleft palate in the pig or non-functional teats in the dam may also contribute to pig deaths.

The causes of baby pig death outlined here account for only about 30 percent of all losses. The large number of deaths due to unidentified factors are probably caused by accidents, poor management, and environmental problems. ARS statistics show the need for new approaches to baby pig management and more careful operations by producers. □

New feed fat for broilers

SOAPSTOCK, a waste product of the soybean industry, shows great promise as a replacement for commercial feed fat in broiler diets.

In trials at Beltsville, Md., animal scientist Henry Menge fed broiler chicks an experimental ration containing a neutralized, dry soybean oil soapstock (NDSS) and a control ration containing a commercial animal and vegetable feed fat (CFF), both at the rate of 4 percent of the diet. Duplicated experiments with 160 chicks on each diet provided the data. In these experiments, no significant differences were noted in body weights or feed conversion rates between birds fed the two kinds of fat.

Soapstock is a byproduct of soybean oil refining. Tighter restrictions on environmental pollution have made its disposal a sticky problem for soybean processors.

Various methods have been tried in handling soapstock. Some of them, such as conversion to salable fatty acids, result in wastewater and other pollutants which are also difficult to dispose of satisfactorily.

Now ARS chemical engineers Robert E. Beal and Virgil E. Sohns at Peoria, Ill., have devised a method for neutralizing and drying the soapstock without producing substances that pollute water or the atmosphere. The only effluent from this NDSS process is water vapor. Cost of making NDSS is estimated at 1½ cents per pound, considerably less than that for CFF.

Two distinct advantages make NDSS desirable in feed. First, tests show that it improves broiler pigmentation, thus

providing a more attractive product for consumers. Second, NDSS has 5 times as much polyunsaturated fat as CFF, while the CFF has 2.4 times more saturated fat than NDSS. This aspect could be even more important in the future as evidence accumulates concerning the relationship of high intake of saturated fats and heart disease.

Though NDSS shows great promise as a feed ingredient, further testing is required before it can be produced commercially.

Disposable pollination units

THE VALUE of crop pollination by honey bees, already estimated in the billions of dollars each year, may someday be enhanced by supplying growers with expendable bees.

Called disposable pollination units (DPU's) the bees would be shipped to growers in disposable packages and distributed throughout fields or orchards. Experiments with the units were conducted by agricultural engineer Benjamin F. Detroy and entomologist Eric H. Erickson of ARS in cooperation with the Wisconsin Agricultural Experiment Station, Madison.

Major problems with the DPU concept have been associated with the type of container and shipment of the bees.

Keeping them alive during shipment is essential. The scientists found that light, or absence of light, was one of the more important physical stimuli to bee activity. When light penetration in the DPU's was lowered, bee mortality was reduced, drifting of bees de-

creased, and comb building and nectar storage increased. In a room with controlled environment, containerized bees responded to increased light with increased activity but also encountered increased mortality.

The new findings may help enlarge the scope of the bee industry.

Vaccinated birds may succumb to MD

OCCASIONALLY, chickens in flocks vaccinated against Marek's disease (MD) succumb to the disease. Why?

The most likely reasons, according to researchers at the ARS Regional Poultry Research Laboratory, East Lansing, Mich., are (1) human error in administering the herpesvirus of turkeys as a vaccine, and (2) biological variation in the efficiency of the vaccine in producing immunity.

Studies by microbiologist William Okazaki, veterinary medical officer H. Graham Purchase, and biologist Ben R. Burmester also show that death losses in vaccinated birds are not caused by new, serologically different MD viruses, or by other known viruses that might cause similar lesions.

The herpesvirus of turkeys may not become established, the scientists suggest, because it was deposited on the skin or in the lumen of the intestine or because amounts insufficient to produce protection were administered.

The research, in cooperation with the Michigan Agricultural Experiment Station, also emphasizes the importance of vaccinating as early as possible. The MD virus can infect chickens in the field

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any time after hatching. Consequently some vaccinated birds that were not protected may have acquired MD virus before the protection conferred by the vaccine had developed.

The researchers found that the herpesvirus of turkeys gave protection against the eight strains of Marek's disease virus isolated from vaccinated chickens that developed lesions. No new strain against which the vaccine was ineffective was identified. The scientists also found no evidence of involvement of related leukosis/sarcoma viruses or reticuloendotheliosis virus.

Two new poinsettias

TWO beautifully colored poinsettias showing exceptional tolerance to light and to air pollution were recently released by the ARS Plant Genetics and Germplasm Institute at Beltsville, Md.

RUFF & READY is a brilliant red plant. Vigorous and compact, it is tough, easy-to-grow, long-lasting, and especially intended for use in breeding programs where resistance to light and air pollution are needed. Cutting production is excellent and rooting fast.

TRULYPINK is a deep salmon-pink plant that breeds true for its unusual delicate color. Unlike present commercial varieties, it is genetically pink in all tissues and will produce pink progeny. It is a large plant and keeps well.

Limited numbers of these two new cultivars are being released for increase and for use in breeding programs.

Cakes are better with butter

NO two ways about it, butter is *the* preferred shortening for yellow layer cake. ARS scientists at the Dairy Products Laboratory in Washington, D.C., confirmed this general impression in a detailed study of cakes made with butter and vegetable shortening. Trained taste panelists consistently preferred the flavor and texture of the all-butter cakes.

Replacing half the vegetable shortening with butter helped some, but the cakes made with this blend tended to be more like those made with all-vegetable shortening than those made with all butter.

Although generally preferred for their rich flavor and soft texture, all-butter cakes have a lower volume than those made with vegetable shortening.

Simply increasing the mixture time from 3 to 5 minutes increased the volume of the all-butter cakes. Adding an emulsifier as well made a slightly higher-volume cake than could be obtained with the vegetable shortening. The cake made with butter was a little firmer when the emulsifier was used, but it was still highly preferred by the taste panel.

When reporting research involving pesticides, this magazine does not imply that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.

